

APPENDIX C - SOCIOECONOMICS

*Jefferson County, Texas Ecosystem Restoration
Feasibility Study*

SOCIOECONOMIC APPENDIX

DEMOGRAPHIC SETTING

GEOGRAPHIC SETTING

Jefferson County is located on the Texas Gulf coast, with the Neches River forming the northeast boundary. Louisiana is east of Jefferson County, separated by Sabine Lake, and the city of Houston is approximately 60 miles to the west. The U.S. Census Bureau estimates a total area of 1,113 square miles within the county's borders, with approximately 78 percent land and 21 percent water. The county seat and largest city is Beaumont, with Port Arthur as the second largest city. Jefferson County, along with the counties of Hardin, Newton, and Orange make up the Beaumont-Port Arthur Metropolitan Statistical Area (MSA). The smallest census designation that contains the study area is census block group 116.1. Based on aerial imagery, the residential structures, hence concentration of population, is in the northwest corner and northeast corner of the census block group.

POPULATION

Jefferson County has an estimated population of 252,993, just less than 1 percent of the state's population and 57 percent of the Beaumont-Port Arthur MSA. Approximately 51 percent of the population is male and 49 percent is female, which is similar to the state, MSA and cities of Beaumont and Port Arthur, as shown in Table 1.

Table 1. Population by Gender

Gender	Texas	Beaumont-Port Arthur Metropolitan Statistical Area	Jefferson County	Beaumont	Port Arthur	Census Block Group 116.1
Total	26,956,435	406,506	252,993	117,729	54,913	957
Male	49.6%	50.5%	51.1%	48.0%	49.2%	50.9%
Female	50.4%	49.5%	48.9%	52.0%	50.8%	49.1%

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

As shown in Table 2, most of the geographic areas have the greatest population in the 25-34, 35-44 and 45-54 year old age groups. The study area is slightly older with the largest populations in the 35-44, 45-54, 55-50 and 60-64 year old age groups. The median age for the state of Texas is 34 years, 36.8 for the MSA, 36 for Jefferson County and 44 for census block group 116.1.

Table 2. Percent of Population by Age Group

Age Group	Texas	Beaumont-Port Arthur Metropolitan Statistical Area	Jefferson County	Beaumont	Port Arthur	Census Block Group 116.1
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Total	26,956,435	406,506	252,993	117,729	54,913	957
<5	7.3%	6.7%	6.9%	7.6%	8.3%	7.5%
5-9	7.5%	6.8%	6.8%	7.0%	8.5%	5.4%
10-14	7.4%	6.5%	6.2%	6.5%	7.1%	6.6%
15-19	7.1%	6.7%	6.6%	7.0%	6.6%	5.7%
20-24	7.3%	7.0%	7.5%	8.8%	6.8%	4.8%
25-34	14.5%	13.7%	14.6%	14.5%	14.7%	6.8%
35-44	13.5%	12.4%	12.5%	11.5%	11.5%	16.0%
45-54	12.9%	13.3%	13.3%	12.1%	12.5%	17.4%
55-59	5.9%	6.8%	6.7%	6.1%	6.7%	8.8%
60-64	5.0%	5.9%	5.7%	5.5%	5.3%	9.2%
65-74	6.8%	7.9%	7.2%	7.4%	6.3%	8.3%
75-84	3.4%	4.5%	4.3%	4.1%	4.0%	1.7%
85+	1.3%	1.8%	1.8%	1.8%	1.6%	1.9%

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

Table 3 provides a summary of the race and Hispanic ethnicity distribution of the populations. For the state, the largest group are those identifying as white, with 43 percent followed by Hispanic at 37 percent and Black/African American at 12 percent. For Jefferson County, there is a higher percentage of Black/African Americans (34 percent) than the state, while the percentage of white is similar. In the census block that contains the project area, the population is considerably more white, at 88 percent, followed by Hispanic at 7 percent and Black/African American at 5 percent.

Table 3. Percent Population by Race/Hispanic Ethnicity

Race and Hispanic Ethnicity	Texas	Beaumont-Port Arthur Metropolitan Statistical Area	Jefferson County	Beaumont	Port Arthur	Census Block Group 116.1
Total	26,956,435	406,506	252,993	117,729	54,913	957
White alone	43.4%	57.7%	42.3%	33.1%	22.0%	87.8%
Black or African American alone	11.6%	24.1%	33.6%	48.0%	38.0%	5.2%
American Indian and Alaska Native alone	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Asian alone	4.3%	2.5%	3.5%	3.1%	6.4%	0.0%
Native Hawaiian or Other Pacific Islander alone	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Some Other Race alone	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Two or more Races	1.6%	1.4%	1.3%	1.1%	1.6%	0.1%
Hispanic or Latino	38.6%	14.0%	19.0%	14.4%	31.8%	6.7%

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

ENVIRONMENTAL JUSTICE

Executive Order 12898 directs federal agencies to identify and address any disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law. CEQ guidance states that minority populations should be identified where either: a) the minority population of the affected area exceeds 50% or b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. Low-income populations should be identified with the annual statistical poverty thresholds from the Bureau of the Census' data. In identifying minority and low-income communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native American), where either type of group experiences common conditions of environmental exposure or effect (CEQ 1997).

The Environmental Protection Agency (EPA) maintains an environmental justice mapping and screening tool (EJSCREEN) that provides users with a nationally consistent dataset and approach for combining environmental and demographic indicators. EJSCREEN can be used as a first-level screening tool to help determine the level of analysis needed. This analysis uses two of the tool's six demographic indicators:¹

- Percent Low-Income: Percent of individuals whose ratio of household income to poverty level in the past 12 months was less than 2.
- Percent Minority: Percent minority as a fraction of population, where minority is defined as all but Non-Hispanic White Alone.

Additionally, the tool estimates a Demographic Index, based on the average of two demographic indicators: Percent Low-Income and Percent Minority.

Census block group 116.1 is the smallest geographical census boundary that includes the entire study area. The census block group has an estimated population of 957. Based on aerial imagery, the majority of the population lives in the northwest and northeast extremes of the census block, which places them outside the study area and project footprint. The output of the EJ Screen tool, with the census block group outlined in blue and the focused study area outline in red is shown in Figure 1 with tabular presentation of the information in Table 4.

Figure 1 shows that the demographic index of the census block group relative to the U.S. is less than the 50th percentile. Anything greater than the 50th percentile would indicate potential concern for environmental justice consideration and warrant additional evaluation. Less than 50% would indicate the concentration of minority and low-income populations were small compared to the region and would therefore not be adversely impacted to a greater degree than the general population.

Table 4 shows 11% of the census block's population is minority, compared to 56% for the state and 24% for the nation. Looking at the percentiles, the data show that that compared to the state, the census block is in the 5th percentile, which means that the census block's minority population of 11% is equal to or less than 5% of the state's population. For there to be environmental justice concerns, the census block would need to be in the 50th or greater percentile. Comparing the U.S.,

¹ Definitions taken from EPA Glossary of EJSCREEN Terms, <https://www.epa.gov/ejscreen/glossary-ejscreen-terms> (last visited 11 FEB 2019).

the census block is in the 24th percentile, again lower than the 50th percentile where there would be environmental concerns.

Low income percentiles show similar results. For the census block, 26% of the population is low income, compared to 38% for the state and 34% for the U.S (Table 4). While the low income indicator is in higher percentiles than the minority population indicator (35th percentile compared to Texas and 40th percentile compared to the U.S.), they are below the 50th percentile

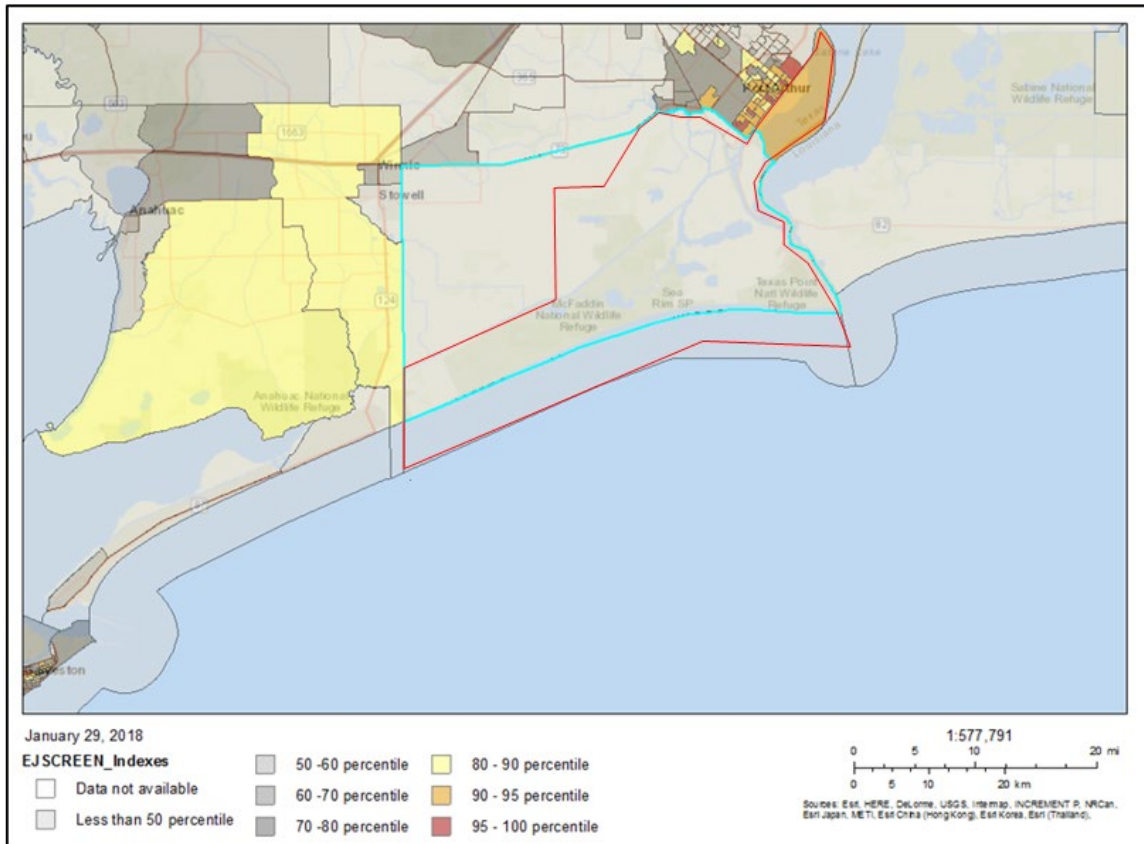


Figure 1. Output of the EJ Screen, with the census block group outlined in blue and the focused study area outlined in red

Table 4. EJ Screen Data for Demographic Indicators for Census Block 116.1, Texas and the United States

Indicator	Census Block 116.1	Texas		United States	
		State Average	Percentile	State Average	Percentile
Minority Population	11%	56%	5	38%	24
Low Income	26%	38%	35	34%	40
Demographic Index	18%	47%	12	36%	26

Source: EJ Screen Tool, U.S. Environmental Protection Agency, <https://ejscreen.epa.gov/>

Given that a relatively small population near the study area and some distant from the project area, that both the minority and low income populations are below 50 percent of the population and below the 50th percentile compared to both the state and national populations, there is no

indication that minority or low income populations would have a disproportionate impact from the Federal actions and no additional steps would be necessary.

COST EFFECTIVE AND INCREMENTAL COST ANALYSIS

SUMMARY OF PLANS

During the early stages of plan formulation, it was decided to develop costs and benefits and conduct cost effective and incremental analysis on fully formed plans, rather than measure by measure. The final array of plans, based on planning strategies, resulted in eight core alternatives (including the No Action alternative), several of which had two scales or variations. Additionally, each of the plans was evaluated using beneficial use materials as source, except for Alternative 6, which was originally formulated using beneficial use as a source. A summary of the alternatives is presented in Table 5.

Table 5. Summary of Alternatives

Alternative	Features	Strategy
Alternative 1A	Nearshore berm and marsh restoration	Indirect (Passive) Alternative: natural restoration of the area and depends on natural systems to sustain the project in the future
Alternative 1B	Sand engines and marsh restoration	
Alternative 2A	Breakwaters and beach nourishment, marsh restoration and GIWW armoring	Direct (Engineered) Alternative: marsh/shoreline/armoring restoration effort designed for long-term solutions to problems
Alternative 2B	Beach nourishment and GIWW armoring	
Alternative 3	Beach nourishment, marsh restoration (mostly south of GIWW), GIWW armoring, no Texas Point Shoreline features	Complementary Alternative: works synergistically with other agency, state, and local plans that are funded
Alternative 4A	No beach nourishment, marsh restoration (around Keith Lake only), minimal GIWW armoring	Keith Lake Alternative: marsh restoration focused around Keith Lake
Alternative 4B	Beach nourishment at Texas Point, no marsh restoration, minimal GIWW armoring	
Alternative 6A	Beach nourishment at Texas Point, marsh restoration	

Alternative 6B	Sand Engine at Texas Point, marsh restoration	Marsh restoration and Texas Point shoreline (beneficial use)
Alternative 10	Breakwaters and beach nourishment, marsh restoration, and GIWW armoring	South of GIWW Focus Alternative: marsh and shoreline restoration between the Gulf of Mexico and the south bank of the GIWW
Alternative 13	Sand Engine at Texas Point, beach nourishment and breakwaters, additional marsh restoration, GIWW armoring	Hybrid alternative to address concerns in constructing breakwaters offshore at Texas Point (offset with Sand Engine concept)

ECOSYSTEM RESTORATION BENEFITS

Average Annual Habitat Units (AAHUs) were developed using marsh and barrier headland modules from the Wetland Valuation Assessment (WVA) for the future without project and with project conditions. The difference between the two represents the benefit, or environmental lift. A summary of the without project, with project and net benefit AAHUs are presented in Table 5.

Table 6. Future Without and With Project Average Annual Habitat Units and Benefits

Alternative	Future Without Project AAHUs			Future With Project AAHUs			Benefits AAHUs		
	Barrier Headland	Brackish Marsh	Total	Barrier Headland	Brackish Marsh	Total	Barrier Headland	Brackish Marsh	Total
1A	100	6,347	6,447	105	12,659	12,764	6	6,312	6,318
1B	100	6,347	6,447	102	12,659	12,761	3	6,312	6,315
2A	100	6,347	6,447	151	12,683	12,834	52	6,337	6,389
2B	100	6,347	6,447	151	8,087	8,238	52	1,741	1,793
3	100	5,752	5,852	151	11,671	11,822	52	5,919	5,971
4A	100	3,531	3,631	100	7,516	7,616	0	3,985	3,985
4B	100	3,531	3,631	151	4,479	4,630	52	948	1,000
6A	100	4,474	4,574	151	9,586	9,737	52	5,112	5,164
6B	100	4,474	4,574	107	9,586	9,693	8	5,112	5,120
10	100	5,586	5,686	151	11,305	11,456	52	5,719	5,771
13	100	6,347	6,447	150	12,683	12,833	51	6,337	6,388
1Abu	100	6,347	6,447	105	12,659	12,764	6	6,312	6,318
1Bbu	100	6,347	6,447	102	12,659	12,761	3	6,312	6,315
2Abu	100	6,347	6,447	151	12,683	12,834	52	6,337	6,389
3bu	100	5,752	5,852	151	11,671	11,822	52	5,919	5,971
4Abu	100	3,531	3,631	100	7,516	7,616	0	3,985	3,985
10bu	100	5,586	5,686	151	11,305	11,456	52	5,719	5,771
13bu	100	6,347	6,447	150	12,683	12,833	51	6,337	6,388

ECONOMIC COSTS AND AVERAGE ANNUAL COSTS

The development of average annual costs are presented in Table 6. Cost Engineering provided construction and real estate costs including economic costs of U.S. Fish and Wildlife lands, a schedule of operation, maintenance, repair, replacement and rehabilitation (OMRRR) costs, cost of outyear nourishments, and construction durations for each of the fully formed plans. Additionally, monitoring and adaptive management costs were estimated for each plan. Monitoring and adaptive management costs for passive plans were estimated at 3 percent of the first cost of initial construction and at 1 percent of first cost of initial construction for engineered plans. Economic costs (inclusive of monitoring and adaptive management costs) were annualized using a 50 year period of analysis and 2.75 percent discount rate and included interest during construction (IDC). For the study, the period of analysis is 2027-2077. Present values for OMRRR and outyear nourishment costs were calculated and those present values amortized over 50 years to develop average annual costs for those items. These annualized investment costs were added to average annual OMRRR and outyear nourishment costs to derive the average annual costs. These average annual costs are the inputs for the CEICA analysis.

Table 7. Project Cost Summary (Initial and Continuing Construction; \$1,000, October 2017 Prices, 2.75% Discount Rate, 50 Year Period of Analysis)

Plan	Construction and Real Estate Costs and Economic Cost for USFWS Lands for Initial Construction	Monitoring and Adaptive Mgmt	Economic Costs	Construction Time (Months)	IDC	Investment Cost	Average Annual Investment Cost	Annualized Out Year Nourishment	Average Annual OMR	Average Annual Costs
1A	\$587,878	\$17,636	\$605,514	120	\$90,094	\$90,094	\$25,766	\$17,662	\$0	\$43,428
1B	922,380	27,671	\$950,051	120	141,357	1,091,408	40,427	21,877	0	62,304
2A	803,231	8,032	\$811,263	180	189,930	1,001,193	37,085	16,198	1,357	54,640
2B	139,465	1,395	\$140,860	120	20,958	161,818	5,994	28,066	446	34,506
3	524,451	5,245	\$529,696	120	78,813	608,509	22,540	31,588	446	54,574
4A	295,017	8,851	\$303,868	60	21,573	325,441	12,055	2,236	52	14,343
4B	95,375	954	\$96,329	60	6,839	103,168	3,821	10,414	52	14,287
6A	222,829	2,228	\$225,057	60	15,978	241,035	8,928	11,512	0	20,440
6B	524,549	15,736	\$540,285	60	38,358	578,643	21,433	1,099	0	22,532
10	692,960	6,930	\$699,890	180	163,856	863,746	31,994	15,542	1,093	48,629
13	1,071,698	10,717	\$1,082,415	180	253,412	1,335,827	49,480	11,694	1,093	62,267
1Abu	341,022	10,231	\$351,253	120	52,263	403,516	14,947	15,513	0	30,460
1Bbu	675,525	20,266	\$695,791	120	103,526	799,317	29,607	19,728	0	49,335
2Abu	556,375	5,564	\$561,939	180	131,559	693,498	25,688	14,049	1,357	41,094
3bu	318,300	3,183	\$321,483	120	47,833	369,316	13,680	29,794	446	43,920
4Abu	129,571	3,887	\$133,458	60	9,475	142,933	5,294	796	52	6,142
10bu	494,688	4,947	\$499,635	180	116,973	616,608	22,840	13,816	1,093	37,749
13bu	824,843	8,248	\$833,091	180	195,041	1,028,132	38,083	9,545	1,093	48,721

Note: "bu" indicates use of beneficial use material as a source

COST EFFECTIVE ANALYSIS

The inputs for CEICA analysis are the annual average habitat units (benefits) and average annual costs. Those inputs are summarized in Table 8.

Table 8. CEICA Inputs

Plan	Benefits (AAHUs)	Annual Cost (\$1,000, October 2017 Prices, 2.75% discount rate)
1A	6,318	\$43,428
1B	6,315	62,304
2A	6,389	54,640
2B	1,793	34,506
3	5,971	54,574
4A	3,985	14,343
4B	1,000	14,287
6A	5,164	20,440
6B	5,120	22,532
10	5,771	48,629
13	6,388	62,267
1Abu	6,318	30,460
1Bbu	6,315	49,335
2Abu	6,389	41,094
3bu	5,971	43,920
4Abu	3,985	6,142
10bu	5,772	37,749
13bu	6,388	48,721

The first step in the analysis is to identify those plans that are cost effective. Plans are considered cost effective if no other plan provides the same level of benefits at a lower cost. Of the 19 plans (including no action) evaluated, five plans, including no action, were identified as cost effective. These are shown in Table 9 as the cost effective and best buy plans. A graphical presentation of the cost effective analysis is shown Figure 2.

Table 9. Results of Cost Effective Analysis

Plan	Annual Cost (\$1000, 2.75% Discount Rate, 50 Year Period of Analysis, October 2017 Prices)	Annual Benefit (AAHU)	Cost Effective
No Action	0	0	Best Buy
1A	\$ 43,428	6,318	No
1B	\$ 62,304	6,315	No
2A	\$ 54,640	6,389	No
2B	\$ 34,506	1,793	No
3	\$ 54,574	5,971	No
4A	\$ 14,343	3,985	No
4B	\$ 14,287	1,000	No
6A	\$ 17,654	5,164	Yes
6B	\$ 22,532	5,120	No
10	\$ 48,629	5,771	No
13	\$ 62,267	6,388	No
1Abu	\$ 30,460	6,318	Best Buy
1Bbu	\$ 49,335	6,315	No
2Abu	\$ 41,094	6,389	Best Buy
3bu	\$ 43,920	5,971	No
4Abu	\$ 6,142	3,985	Best Buy
10bu	\$ 37,749	5,772	No
13bu	\$ 48,721	6,388	No

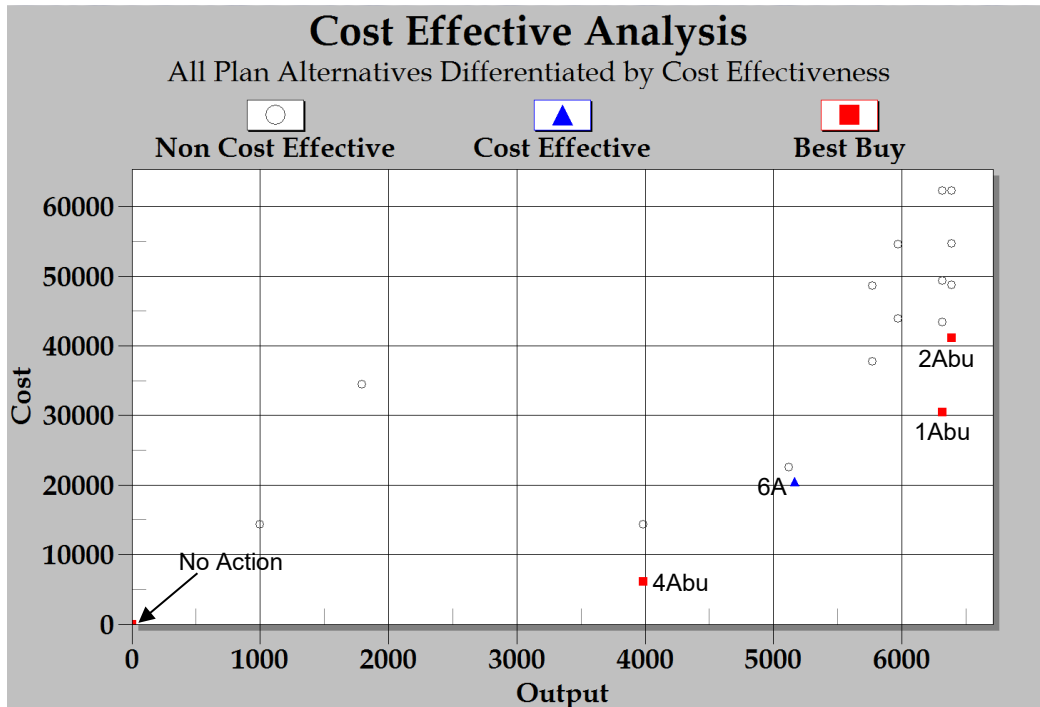


Figure 2. Cost Effective Analysis

INCREMENTAL COST ANALYSIS

Once the cost effective plans are identified, the next step in the analysis is to identify the best buy array. This process steps through each of the cost effective plans to identify the plan with the lowest incremental cost per incremental benefit. The first best buy plan, or the plan with the least incremental cost per incremental benefit over the no action plan was plan 4ABU. This plan has an incremental cost per incremental output of \$1.5 thousand. It provides 3,985 AAHUs over the no action plan. The project economic cost (including initial construction and continued construction) is \$133 million.

The second best buy plan, or the plan with the lowest incremental cost per incremental benefit, from 4Abu is 1Abu. The incremental cost per incremental benefit is \$10.4 thousand, an almost 10 fold increase from the incremental cost per benefit of 4Abu. It provides 6,318 AAHUs, an increase of 2,333 from 4Abu. The project economic cost is \$680 million.

The final best buy plan is 2Abu. It has an incremental cost per incremental benefit over 1Abu of \$150 thousand. It provides 6,389 AAHU of benefit, an increase of 71 over 1Abu. The project economic cost is \$1.4 billion. These plans are summarized in Table 10 and Figure 3.

A complete discussion of the direct and indirect benefits and the criteria for plan selection will be presented in the “Is It Worth” discussion in the main report.

Table 10. Results of Incremental Cost Analysis

Plan	Output (AAHU)	Annual Cost (\$1,000)	Average Cost (\$1000/AAHU)	Incremental Cost (\$1,000)	Incremental Output (AAHU)	Incremental Cost/Incremental Output (\$1,000)
No Action	0	\$0				
4Abu	3,985	\$6,142	\$1.54	\$6,142	3,985	\$1.54
1Abu	6,318	\$30,460	\$4.82	\$24,318	2,333	\$10.42
2Abu	6,389	\$41,094	\$6.43	\$10,634	71	\$149.77

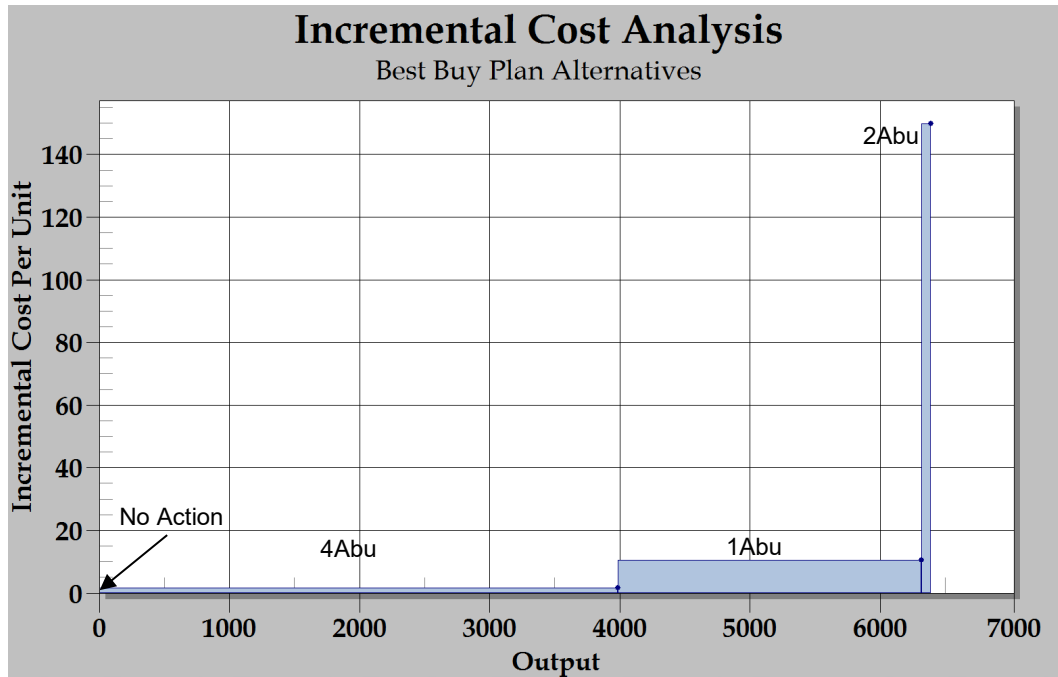


Figure 3. Incremental Cost Analysis of Best Buy Plan

REVISIONS MADE FOLLOWING AGENCY DECISION MILESTONE

Following the Agency Technical Review and Agency Decision Milestone Discussions, two changes occurred that could potentially alter plan formulation and selection. First, it had been determined that out year nourishments that had been treated as continued construction should not be considered as part of the project costs. Secondly, it was determined that acquisition of private lands would not be pursued, and only state or federal owned lands would be considered. These two changes would not only reduce costs, but also the benefits associated with the alternatives, and while the project delivery team believed it would effect alternatives proportionately, the step was taken to develop cost and benefit estimates, using the same methodologies, and perform a CEICA validation of the new numbers to make sure the best buy array and recommended plan would not change. The following tables and graphs provide the inputs and results of this analysis. It should be noted that the new runs used October 2018 prices and a 2.875% federal interest rate.

Table 11. Future Without and With Project Average Annual Habitat Units and Benefits with Private Lands and Continued Construction Removed

Alternative	Future Without Project AAHUs			Future With Project AAHUs			Benefits AAHUs		
	Barrier Headland	Brackish Marsh	Total	Barrier Headland	Brackish Marsh	Total	Barrier Headland	Brackish Marsh	Total
1A	119	4,936	5,055	131	9,182	9,313	12	4,246	4,258
1B	119	4,936	5,055	152	9,182	9,334	33	4,246	4,279
2A	119	4,936	5,055	162	9,182	9,344	42	4,246	4,288
2B	119	4,936	5,055	121	6,323	6,444	2	1,387	1,389
3	90	2,853	2,943	99	5,097	5,196	8	2,244	2,252
4A	119	2,737	2,856	119	5,432	5,551	0	2,695	2,695
4B	30	2,737	2,767	28	3,508	3,536	-2	771	769
6A	30	3,387	3,417	28	6,769	6,797	-2	3,382	3,380
6B	30	3,387	3,417	34	6,769	6,803	5	3,382	3,387
10	119	4,480	4,599	161	8,455	8,616	42	3,974	4,016
13	119	4,936	5,055	158	9,182	9,340	39	4,246	4,285
1Abu	119	4,936	5,055	131	9,182	9,313	12	4,246	4,258
1Bbu	119	4,936	5,055	152	9,182	9,334	33	4,246	4,279
2Abu	119	4,936	5,055	192	9,182	9,374	72	4,246	4,318
3bu	90	2,853	2,943	99	5,097	5,196	8	2,244	2,252
4Abu	119	2,737	2,856	119	5,432	5,551	0	2,695	2,695
10bu	119	4,480	4,599	161	8,455	8,616	42	3,974	4,016
13bu	119	4,936	5,055	158	9,182	9,340	39	4,246	4,285

Table 12. Project Cost Summary with Private Lands and Continued Construction Removed; \$1,000, October 2018 Prices, 2.875% Discount Rate, 50 Year Period of Analysis

Plan	Construction and Real Estate Costs and Economic Cost for USFWS Lands for Initial Construction	Monitoring and Adaptive Management	Economic Costs	Construction Time (Months)	Interest During Construction	Investment Cost	Average Annual Investment Cost	Annual Operations & Maintenance	Annualized Repair, Replacement and Rehabilitation	Average Annual Costs
1A	\$360,042	\$10,801	\$370,843	120	\$57,895	\$428,738	\$16,270	\$5,440	\$0	\$21,710
1B	694,544	20,836	\$715,380	120	111,684	827,064	31,386	18,037	0	49,423
2A	622,737	6,227	\$628,964	180	154,855	783,819	29,744	6,483	0	36,227
2B	139,659	1,397	\$141,056	120	22,021	163,077	6,188	10,690	0	16,878
3	397,661	3,977	\$401,638	120	62,703	464,341	17,621	6,918	0	24,539
4A	206,623	6,199	\$212,822	60	15,819	228,641	8,677	58	0	8,735
4B	66,816	668	\$67,484	60	5,016	72,500	2,751	3,840	0	6,591
6A	147,027	1,470	\$148,497	60	11,038	159,535	6,054	3,782	0	9,836
6B	448,746	13,462	\$462,208	60	34,357	496,565	18,844	0	0	18,844
10	566,985	5,670	\$572,655	180	140,992	713,647	27,082	6,483	0	33,565
13	891,437	8,914	\$900,351	180	221,673	1,122,024	42,579	4,590	0	47,169
1Abu	186,718	5,602	\$192,320	120	30,025	222,345	8,438	5,440	0	13,878
1Bbu	521,220	15,637	\$536,857	120	83,813	620,670	23,553	18,037	0	41,590
2Abu	449,413	4,494	\$453,907	180	111,755	565,662	21,466	6,483	0	27,949
3bu	234,842	2,348	\$237,190	120	37,030	274,220	10,406	6,918	0	17,324
4Abu	81,883	2,456	\$84,339	60	6,269	90,608	3,438	58	0	3,496
10bu	412,044	4,120	\$416,164	180	102,463	518,627	19,681	6,483	0	26,164
13bu	718,113	7,181	\$725,294	180	178,573	903,867	34,300	4,590	0	38,890

Table 13. CEICA Inputs (with removal of private lands and continued construction)

Alternative	Benefits (AAHUs)	Annual Cost (\$1,000, October 2018 Prices, 2.875% Interest Rate)
1A	4,258	\$21,710
1B	4,279	49,423
2A	4,288	36,227
2B	1,389	16,878
3	2,252	24,539
4A	2,695	8,735
4B	769	6,591
6A	3,380	9,836
6B	3,387	18,844
10	4,016	33,565
13	4,285	47,169
1Abu	4,258	13,878
1Bbu	4,279	41,590
2Abu	4,318	27,949
3bu	2,252	17,324
4Abu	2,695	3,496
10bu	4,016	26,164
13bu	4,285	38,890

Table 14. Results of Cost Effective Analysis (with removal of private lands and continued construction)

Plan	Annual Cost (\$1000, 2.875% Discount Rate, 50 Year Period of Analysis, October 2018 Prices)	Annual Benefit (AAHU)	Cost Effective
No Action			Best Buy
1A	\$21,710	4,258	No
1B	\$49,423	4,279	No
2A	\$36,227	4,288	No
2B	\$16,878	1,389	No
3	\$24,539	2,252	No
4A	\$8,735	2,695	No
4B	\$6,591	769	No
6A	\$9,836	3,380	Yes
6B	\$18,844	3,387	No
10	\$33,565	4,016	No
13	\$47,169	4,285	No
1Abu	\$13,878	4,258	Best Buy
1Bbu	\$41,590	4,279	No
2Abu	\$27,949	4,318	Best Buy
3bu	\$17,324	2,252	No
4Abu	\$3,496	2,695	Best Buy
10bu	\$26,164	4,016	No
13bu	\$38,890	4,285	No

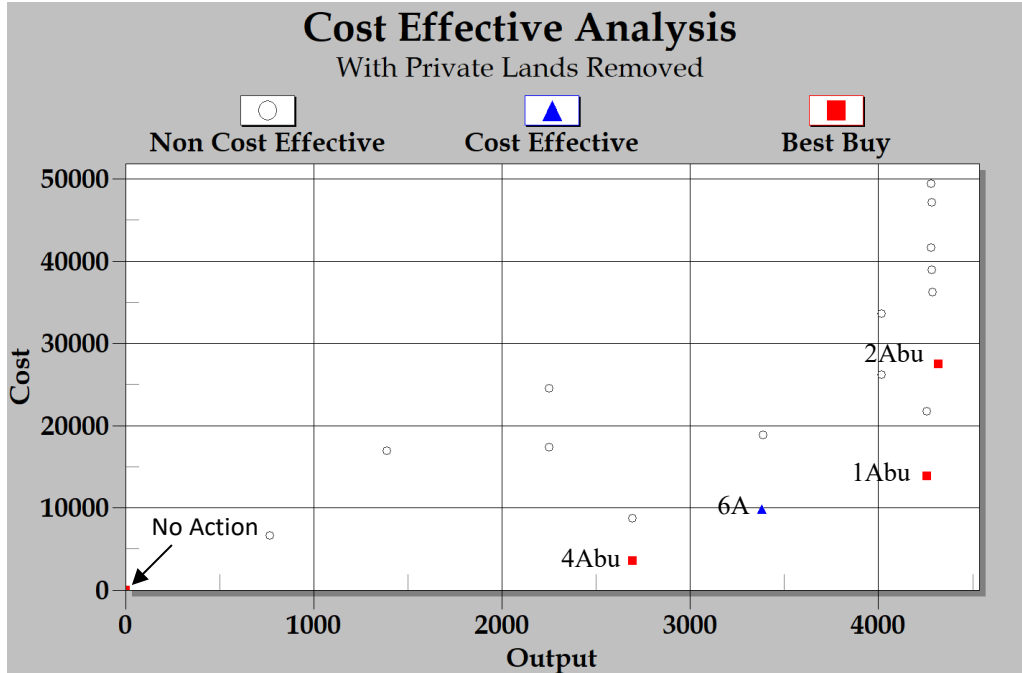


Figure 4. Cost Effective Results (with removal of private lands and continued construction)

Table 15. Results of Incremental Analysis (with removal of private lands and continued construction) (October 2018 prices, 2.875% interest rate)

Plan	Output (AAHU)	Annual Cost (\$1,000)	Average Cost (\$1000/AAHU)	Incremental Cost (\$1,000)	Incremental Output (AAHU)	Incremental Cost/ Incremental Output (\$1,000)
No Action	0	\$0				
4Abu	2,695	\$3,496	\$1.30	\$3,496	2,695	\$1.30
1Abu	4,258	\$13,878	\$3.26	\$10,382	1,563	\$6.64
2Abu	4,318	\$27,494	\$6.37	\$13,616	60	\$226.93

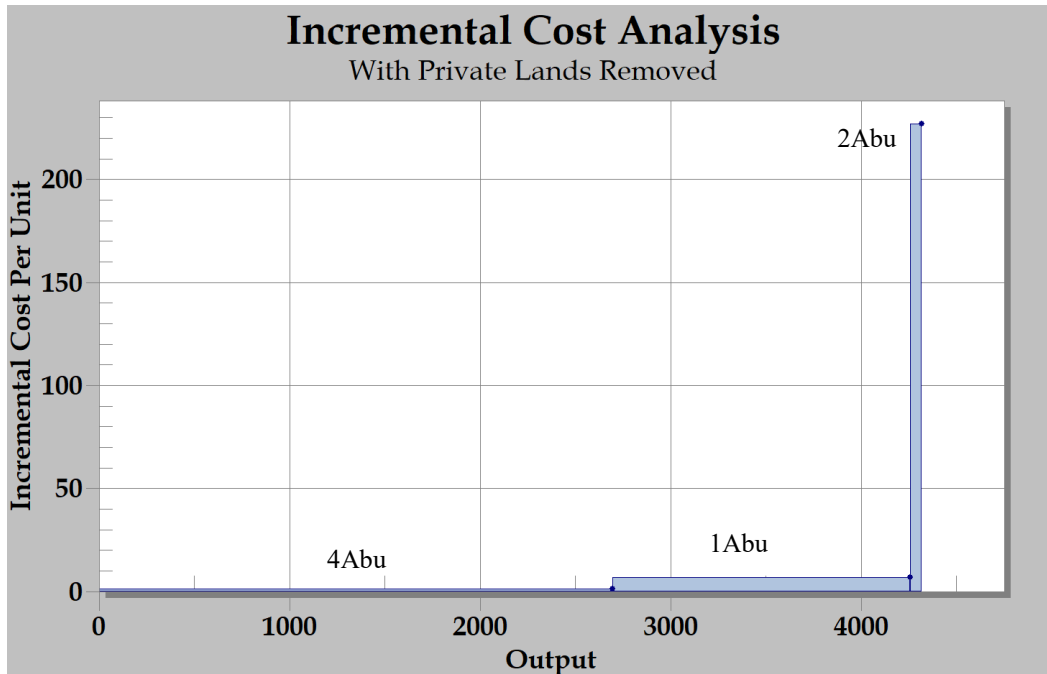


Figure 5. Incremental Cost Analysis (with removal of private lands and continued construction)

Looking at the incremental cost analysis, the plan with the least incremental cost per incremental benefit over the no action plan is 4ABU. The incremental cost per incremental benefit is \$1,300. It has an annual benefit of 2,695 AAHUs with estimated first cost of \$84.3 million.

Alternative 1Abu provides the next least incremental cost per incremental benefit (compared to Alt 4Abu) of \$6,640. It has an annual benefit of 4,258 AAHUs, an increase of 1,563 AAHUs over 4Abu. The estimated first cost is \$192.3 million.

Alternative 2Abu provides the next least incremental cost per incremental benefit (compared to Alt 1Abu) of \$227,000. It has an annual benefit of 4,318 AAHUs, an increase of 60 AAHUs over Alternative 1Abu. The estimated first cost is \$453.9 million.

As a result of the CEICA analysis using inputs that removed costs and benefits associated with private lands and continued construction (out year nourishment), Alternative 4Abu would still be selected as the recommend plan based on the same selection process and previously discussed and presented, though the total benefits (environmental lift) and project first costs have been reduced.

PROJECT FIRST COST AND ANNUAL COSTS AFTER COST RISK ANALYSIS

After plan selection, the recommended plan costs and schedules were subjected to a cost and schedule risk analysis. The resulted in a reduction in overall project first costs, primarily driving by a reduction in contingency costs, and is described in detail in the cost engineering appendix.

The resulting project first cost for Alternative 4Abu is estimated at \$62,252,000. This includes \$2,579,000 for monitoring and adaptive management. OMRRR costs were annualized by calculating the present value of the future cost and annualizing over the planning period of 50 years, resulting in an annual OMRRR cost of \$66,000. The annual project first costs, including OMRRR, is estimated at \$2,604,000, as shown in Table 14.

Table 16. Calculation of Annual Cost (\$1,000, October 2018 Prices, 2.875% Interest Rate, 50 Year Period of Analysis)

Estimated First Cost	\$62,252
Annual Interest Rate	2.875
Period of Analysis (Years)	50
Construction Period (Months)	72
Interest During Construction	\$5,607
Total Investment Costs	\$67,859
Annual Costs	
Interest	\$1,951
Amortization	\$624
OMRRR	\$66
Total Annual Costs	\$2,641

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